

**USC Environmental Health and Safety  
Columbia, South Carolina**

**Air Permit Application  
for  
Installation of Electrostatic Precipitator for Biomass Gasification System**

January 2007

**Executive Summary**

The University of South Carolina Department of Environmental Health and Safety (“USC”) in Columbia, SC (Part 70 Air permit number TV-1900-0143) submits the following permit application for the proposed installation of an electrostatic precipitator (ESP) on the exhaust of the permitted Biomass Gasification System for control of particulate matter. Installation of this ESP will ensure operation of the Biomass Gasification System in compliance with recently promulgated federal New Source Performance Standard 40 CFR 60 Subpart Dc for particulate matter.

This submittal includes a detailed analysis of regulatory requirements and shows that USC is capable of operating this source in compliance with all applicable air pollution regulations.

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**Controlled Emission Limits Requested  
ESP on Biomass Gasification Exhaust**

Pollutant	Max Potential to Emit	
	(lb/hr)	(ton/yr)
Particulate Matter	0.03	0.1314

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**LIST OF ABBREVIATIONS USED**

AAQS .....	Ambient Air Quality Standards (SC Reg. 61-62.5 Standard 2)
acfm .....	Actual Cubic Feet per Minute
BACT .....	Best Available Control Technology
BAQ .....	Bureau of Air Quality (SC DHEC)
BGS .....	Biomass Gasification System
CAAA.....	Clean Air Act Amendments of 1990
CFR .....	Code of Federal Regulations
COM.....	Continuous Opacity Monitor
DHEC .....	SC Department of Health and Environmental Control
EPA .....	US Environmental Protection Agency
fps.....	Feet per Second
HAP .....	Hazardous Air Pollutant(s) (as Defined in CAA, Section 112(b))
LAER.....	Lowest Achievable Emission Rate (SC Reg. 61-62.5 Standard 5.1)
MACT .....	Maximum Achievable Control Technology
NESHAP.....	National Emission Standard for Hazardous Air Pollutants (40 CFR 61 and 63)
NSPS .....	New Source Performance Standard (40 CFR 60)
PM.....	Particulate Matter
PM <sub>10</sub> .....	Particulate Matter with Aerometric Diameter < 10 Microns
PSD .....	Prevention of Significant Deterioration (SC Reg. 61-62.5 Standard 7)
TAP .....	Toxic Air Pollutant(s) (SC Reg. 61-62.5 Standard 8)
TPY/tpy .....	Tons Per Year
USC .....	University of South Carolina
VOC .....	Volatile Organic Compound(s)
WCR.....	Waste Combustion and Reduction (SC Reg. 61-62.5 Standard 3)

## SECTION 1 - GENERAL INFORMATION

The University of South Carolina (“USC”) owns and operates boilers at three physical plants on their Columbia, SC campus under South Carolina Dept. of Health and Environmental Control, Bureau of Air Quality Air Permit No. TV-1900-0143. These physical plants meet the steam/heat needs of the USC Columbia Campus.

USC recently applied for and was granted a NSPS/Synthetic Minor Construction Permit (1900-0143-CH) to install a Biomass Gasification System (BGS) that will be fueled by wood chips. This system will gasify the wood chips to provide a clean fuel source for steam and electricity generation for the USC Columbia Campus. A significant portion of the existing steam capacity of the current physical plants as well as some electrical demand will be met by this new system.

According to the interpretation of representatives of the SC Dept. of Health and Environmental Control, Bureau of Air Quality (“BAQ”), this new BGS currently under construction will be subject to newer, more stringent federal New Source Performance Standards for Particulate Matter (PM) as finalized on February 9, 2006. USC proposes to install an electrostatic precipitator (ESP) in order to meet this more stringent standard for PM.

The following sections of this report describe the proposed ESP installation and demonstrate that this installation will satisfy the allegedly applicable revised PM standard.

## SECTION 2 - PROPOSED CONSTRUCTION/MODIFICATIONS

### **2.1 Process Description**

USC proposes to install an Electrostatic Precipitator (ESP) to reduce Particulate Matter (PM) emissions in the exhaust stream of the Biomass Gasification System currently under construction on the Columbia campus of USC.

The ESP will remove particles from the BGS exhaust gases by applying an electrical charge through discharge electrodes to the airborne particles and collecting the particles on oppositely charged collecting plates. Particles “caked” onto collecting plates will be removed by mechanically rapping the collecting plates at regular intervals allowing the caked dust to fall into collecting hoppers at the bottom of the ESP unit. Collected dust in the hoppers will be automatically removed at regular intervals via gravity feed through airlocks to prevent stack gas leakage. The dust will then be mechanically conveyed through an enclosed system to a disposal container.

The ESP will be installed in the stack gas exhaust stream between the final exhaust blower and the vertical exhaust stack. This will be achieved by inserting an additional section of exhaust conduit between the exhaust blower fan and the final stack to accommodate the placement of the ESP (see flow diagram in appendix B of this report). No alteration to the final stack location or stack height as proposed and approved by BAQ construction permit 1900-0143-CH will be required for this ESP installation.

The manufacturer of this ESP, PPC Industries, guarantees that the ESP will control PM emissions in the stack gases to a level at or below that of the allegedly applicable New Source Performance Standard of 0.03 lbs. per million Btu of heat input. Table 2-1 below shows pertinent details of the ESP as provided by the manufacturer. Additional specifications for the ESP provided by PPC Industries are included in appendix A of this report.

Table 2-1, ESP Specifications

Process Information:	
Exhaust Gas Volume	55,800 acfm
Exhaust Gas Temp.	318 <sup>°</sup> F
ESP Gas Velocity	4.8 fps
ESP Treatment (Dwell) Time	4.8 seconds
ESP SCA (collecting area to gas ratio)	161 ft <sup>2</sup> /1000 acfm
ESP Pressure Drop	0.5 inches of H <sub>2</sub> O
Process Emissions Data	
Guaranteed PM Emission Rate	= 0.03 lb./10 <sup>6</sup> Btu Heat Input (Method 5)
Guaranteed Opacity	= 20% (Method 9)



## **2.2 Process Location**

The BGS with installed ESP will be located on the USC Columbia campus on the lot encompassed by Catawba, Sumter and Whaley Streets. This location is the same location as originally proposed and approved by BAQ construction permit 1900-0149-CH. As previously stated, no changes are being made to the locations of any critical equipment or to the final exhaust stack location and height (see exhibit B, showing planned location of stack).

## SECTION 3 - REGULATION OVERVIEW AND APPLICABILITY

Following is an outline of existing regulations governing emission of air pollutants. The Federal air pollution control regulations (not encoded into SC Regulation 61-62) are addressed first followed by air pollution control regulations encoded into SC law. Regulations requiring dispersion modeling are addressed as a separate category.

### 3.1 Federal Regulation Review

The following regulations have been promulgated on the Federal level but are not specifically encoded in the SC Air Pollution Control Regulations (SC Reg. 61-62). Although delegation of enforcement authority is granted to South Carolina, the authority for promulgation, interpretation and revisions of these regulations remains at the Federal level.

#### 3.1.1 40CFR 60 - New Source Performance Standards

Federal standards have been implemented for specific equipment types or processes (e.g., boilers, mining operations, coating operations, etc.) manufactured or modified after the effective date of the standard. These impose specific restrictions on the amounts of pollutants emitted and require either proactive waste reduction techniques (e.g., low VOC solvents) or retrofit controls to ensure that the affected facility can meet the standard.

*Federal New Source Performance Standard 40 CFR 60, Subpart Dc (40CFR60.40c-48c) applies to the BGS since it qualifies as a fuel fired industrial steam generator with a heat input rating greater than 30 million Btu's per hour but less than 100 million Btu's per hour. Representatives of the BAQ have determined that this facility is subject to the more stringent PM standard (finalized 02/09/2006) of paragraph 60.43c(e)(1) which requires PM emissions to be limited to not more than 0.03 lb/10<sup>6</sup>Btu heat input. The ESP is being installed to comply with the newer, more stringent PM limits.*

*Under 60.43c(c), the standard also limits stack gas opacity to not more than 20% except for periods of startup, shutdown or malfunction. Under 60.47c(a), because this unit is subject to the opacity standard of 60.43c(c), the standard also requires installation of a continuous opacity monitor (COM).*

*PM limit:                      = 0.03 lb/10<sup>6</sup>Btu heat input*

*Opacity limit:                = 20%*

### 3.1.2 40CFR 61 and 63 - National Emission Standards for Hazardous Air Pollutants

These standards apply to equipment or processes emitting specific HAP. They impose strict limitations and testing requirements on affected processes and, on a case by case basis, may require the affected sources to be subject to other federal regulations (e.g., Title V Operating Permit Program) by virtue of being a NESHAP applicable source. NESHAP sources covered in 40 CFR 63 are required to implement Maximum Achievable Control Technology (MACT) to the affected facilities.

*There are no 40 CFR 61 (pre-1990 CAAA NESHAP) standards applicable to this process.*

*USC is not currently a major source of HAP, and will not by virtue of installation of this process become a major source of HAP; therefore, there are no 40 CFR 63 (1990 CAAA MACT) standards applicable to this process.*

### 3.1.3 40CFR 64 - Compliance Assurance Monitoring (CAM)

The Compliance Assurance Monitoring (CAM) rule applies to any process unit which:

- (1) is subject to an emission limit or standard for a regulated air pollutant,
- (2) uses a control device to achieve compliance with that standard, and

(3) has the uncontrolled potential to emit 100% or more of the major source threshold of any regulated air pollutant.

The rule is designed to provide a reasonable assurance of compliance with the applicable emissions standard through monitoring operating parameters of the control device and process unit that correlate to a satisfactory and compliant operating state of the control device.

*The CAM rule is not applicable to this BGS since the process unit by itself does not have uncontrolled emissions of regulated air pollutants at or above major source levels.<sup>1</sup>*

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<sup>1</sup> Refer to the “Uncontrolled Potential Emissions” table, bottom of Page 1 of BAQ “Engineering Calculation Sheet” included in Appendix C of this report.

### 3.2 South Carolina Regulation Review

The following rules are encoded in SC Air Pollution Control Regulations (SC Reg. 61-62).

#### 3.2.1 SC Reg. 61-61.5 Std. 1 - Emissions from Fuel Burning Operations

This regulation applies only to “fuel burning operations”<sup>2</sup> and applies specific, PM, SO<sub>2</sub>, and Opacity limitations based on the age and size of the source. Testing requirements and/or installation of continuous monitors are imposed for some sources based on size and the fuel being burned.

*The BMG is a fuel burning operation (as defined by SC Regulation 61-62.1). Standard 1 imposes the following limits:*

*PM limit: = 0.6 lb/10<sup>6</sup> Btu heat input*

*SO<sub>2</sub> limit: = 3.5 lb/10<sup>6</sup> Btu heat input*

*Opacity limit: = 20%*

*The limitations imposed by federal NSPS Subpart Dc (see paragraph 3.1.1 above) are more stringent for PM.*

#### 3.2.2 SC Reg. 61-61.5 Std. 3 - Waste Combustion and Reduction

A source which burns any substance other than virgin fuel for any reason is subject to the requirements of this regulation. Depending on the type of waste or non-virgin fuel being burned, the restrictions and requirements can be very stringent.

*Only untreated wood is burned in this process. There is no waste combustion taking place in this process, therefore, this regulation does not apply.*

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<sup>2</sup> Fuel Burning Operation is defined in SC Reg. 61-62.1 as “...a device or mechanism used principally ... to burn any fuel for the purpose of indirect heating in which the material being heated is not contacted by and adds no substance to the products of combustion.”

### 3.2.3 SC Reg. 61-61.5 Std. 3.1 - Medical Waste Incineration

*There is no medical waste incineration taking place in this process, therefore, this regulation does not apply.*

### 3.2.4 SC Reg. 61-62.5 Std. 4 - Emissions from Process Industries

Emission standards are imposed for various pollutants depending on the process. The limitations are based on process throughput weight rates (hourly weight of some or all materials going into the process) and are either calculated by an equation or tabulated within the regulation. Monitoring, record keeping, reporting and source testing are required for specific processes. Additionally, standards of opacity are imposed for emissions from any industrial operation not covered elsewhere.

*PM Emissions from this process are subject to the more restrictive limits imposed by federal NSPS Subpart Dc and SC Regulation 61-62.5 Standard 1 (Fuel Burning); therefore, this standard is superceded.*

### 3.2.5 SC Reg. 61-62.5 Std. 5 - Volatile Organic Compounds

This standard applies only to processes which were in existence on either July 1, 1979 or July 1, 1980 depending on the process and only to plants having the plant wide potential to emit more than 150 lb/hr or 550 lb/day of VOC (nominally 100 tpy). The standard applies to each listed process which was in existence on the applicable date any time plant wide potential to emit VOC exceeds the listed amounts even if the standard did not apply when it was promulgated due to plant size. Depending on the process involved, different compliance schedules are imposed when

the process becomes subject to the standard. Limitations on VOC emissions, monitoring, record keeping and testing are required depending on the process.

*This facility is being built after 1980, therefore, this regulation does not apply.*

### 3.2.6 SC Reg. 61-62.5 Std. 5.1 - BACT / LAER for VOC

This regulation requires a review of VOC emission increases at a plant since July 1, 1979. If a net increase in VOC emissions of 100 tpy or more has occurred at a plant or will occur as a result of a modification since that date, controls qualifying as either Best Achievable Control Technology (BACT) or Lowest Achievable Emission Rate (LAER) technology (depending on whether the increase is after or before 2004) must be applied to the proposed modification.

*The addition of this process will not cause a net annual VOC emissions increase greater than 100 tpy from this source since 1979; therefore, this regulation does not apply.*

### 3.2.7 SC Reg. 61-62.5 Std. 5.2 - Control of Oxides of Nitrogen

This regulation applies to any new combustion source installed after June 25, 2004 including full burner replacements and moves of existing combustion equipment. Certain small sources or sources that already have BACT installed for NO<sub>x</sub> are exempted. Sources for which this rule applies are required to have controls installed in order to meet specific NO<sub>x</sub> limitations as detailed by this rule.

*The BGS has been evaluated based on this standard and a BACT NO<sub>x</sub> limitation of 0.2 lb/10<sup>6</sup> Btu heat input has been determined.*

### 3.2.8 SC Reg. 61-62.5 Std. 6 - Alternative Emission Limitation Options (“Bubble”)

This “bubble” policy provides procedures which allow existing plants to be excused from installing pollution controls at one or more emission sources in exchange for compensating increases in control at other emission sources. Each “bubble” must be equivalent to the original emission limits in terms of ambient impact and enforceability. Bubbles cannot be used to meet technology based requirements applicable to new sources.

*No “bubble” is being requested for this facility at this time.*

### 3.2.9 SC Reg. 61-62.5, Std. 7 - Prevention of Significant Deterioration (PSD)

This regulation applies to “major plants”<sup>3</sup> undergoing modifications that will cause a “significant increase”<sup>4</sup> of regulated air pollutant emissions. Sources requiring PSD review must apply Best Available Control Technology (BACT) to the proposed modification and submit detailed information on expected impacts of the increased emissions out to a 100 km radius from the source. Depending on the proximity of federally protected lands (national parks, wilderness areas, wildlife refuges, etc.) a detailed modeling study including five years of meteorological data must be performed. In addition, new sources being installed in counties where a PSD facility has been established may be subject to reduced allowable offsite concentrations of specific regulated pollutants.

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<sup>3</sup> A major plant is defined as one of 28 specifically listed sources having the potential to emit 100 tpy or more of any one pollutant regulated by the Federal Clean Air Act or any plant having the potential to emit 250 tpy or more.

<sup>4</sup> A significant increase is defined on a pollutant by pollutant basis in tons per year under Section I, Part V of the PSD regulation.



*USC has requested and been granted federally enforceable “synthetic minor” limitations to remain below the “major plant” threshold. Addition of this ESP will only serve to further reduce PM emissions and not adversely affect the synthetic minor status of this source.*

#### 3.2.10 SC Reg. 61-62.6 - Control of Fugitive Particulate Matter

This regulation applies to operations having fugitive dust emissions and requires measures to be taken to reduce fugitive dust emissions offsite as much as practicable.

*No fugitive dust will be generated by the addition of this ESP; therefore, this regulation does not apply.*

#### 3.2.11 SC Reg. 61-62.63 - NESHAP Section 112(g) MACT “Hammer”

This regulation applies to construction of major sources of hazardous air pollutants (“HAP”) that are not subject to a promulgated National Emission Standard for Hazardous Air Pollutants (NESHAP) under 40 CFR 63. Special emission reduction requirements apply under the Maximum Achievable Control Technology (MACT) guidelines.

*Emissions of HAP are below major source thresholds for USC. Addition of this ESP will not cause any additional HAP to be emitted from this facility and will not cause USC to be subject to a “MACT Hammer.”*

#### 3.2.12 SC Reg. 61-62.68 - Chemical Accident Prevention Provisions: “112(r)”

This regulation applies to specific processes and facilities storing listed substances in greater than specified threshold quantities. Facilities subject to this rule must prepare a Risk Management Plan

(RMP) for prevention of accidental releases and provisions for emergency protection of surrounding communities in the event of a release.

*This project will not cause any Section 112(r) listed substances to be stored in quantities above listed thresholds and will not require preparation of an RMP.*

### 3.2.13 SC Reg. 61-62.70 - Title V Operating Permit Program

This regulation, driven by the 1990 amendments to the federal Clean Air Act, requires submittal of a complete application for a Title V Operation Permit within twelve months of becoming subject to the permit program. All “major sources”<sup>5</sup> are subject to the program.

*USC is subject to the Title V Operating Permit Program and is operating under the terms of Part 70 Air Permit TV-1900-0143. USC has already been granted a permit to construct the BGS. Installation of this ESP will reduce potential to emit PM. USC will request that the BGS with ESP be added to their Part 70 air permit in accordance with SC Regulation 61-62.70.*

## 3.3 Regulations Requiring Air Dispersion Modeling

The state of South Carolina ensures continued ambient air concentrations of air pollutants at safe (or federally established) levels by requiring individual sources to prove that the impact of their air pollutant emissions will not exceed established limits at any time at ground levels at or beyond their property boundaries. The SCDHEC Bureau of air Quality (“BAQ”) established method of demonstrating acceptable pollutant impacts is through computer assisted modeling of dispersion of air pollutants. Input values of actual emission rates and atmospheric affects are run through a

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<sup>5</sup> A stationary source or group of stationary sources on contiguous properties and under common control having the potential to emit 10 tpy of any single HAP, 25 tpy of any combination of HAP, or 100 tpy of any pollutant regulated by the federal Clean Air Act.

series of repetitive calculations which demonstrate theoretical worst case concentrations in ambient air of the subject pollutant at specified distances from the point of emission.

### 3.3.1 SC Reg. 61-62.5 Std. 2 - Ambient Air Quality Standards

Maximum ambient air concentrations of certain air pollutants deemed “criteria pollutants”<sup>6</sup> have been established by the federal EPA for all regions of the United States. The state of SC is subject to meeting these requirements on penalty of losing “attainment status” (being in attainment of all criteria pollutant standards as shown by air monitoring across the state) as granted by the EPA. In order to ensure that industrial emissions of air pollutants do not threaten the attainment status of SC, the BAQ has adopted a policy of requiring individual stationary sources of air pollutant emissions to demonstrate via computerized dispersion modeling that the impacts of their emissions do not cause any criteria pollutant to exceed the established limit concentrations at ground levels at or beyond their property boundaries. All facilities having criteria pollutant emissions (with the exception of non-HAP VOC) are required to demonstrate compliance using dispersion modeling.

*A demonstration of compliance with AAQS has already been performed for USC by the BAQ. Addition of this ESP will not change any of the stack parameters modeled except for a reduction in PM emission rate; therefore, no additional modeling for demonstration of compliance with the AAQS is necessary.*

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<sup>6</sup> The national criteria pollutants are PM<sub>10</sub> (particulate matter having a maximum aerometric diameter of 10 microns or less), Sulfur Dioxide (SO<sub>2</sub>), Nitrogen Oxides (NO<sub>x</sub>), Carbon Monoxide (CO), Ozone (O<sub>3</sub>, emissions of VOC are considered to significantly contribute to O<sub>3</sub> formation), and Lead (Pb). SC has added to the list Total Suspended Particulates (PM having no specific size threshold) and Gaseous Fluorides (as HF).

### 3.3.2 SC Reg. 61-62.5 Std. 8 - Toxic Air Pollutants

This regulation addresses over 250 substances determined to be in one of three levels of health threatening toxicity (low toxicity, moderate toxicity, and high toxicity). Similar to the policy established for the AAQS, this regulation requires all sources emitting listed TAP (except virgin fuel oil or on-specification waste oil burning operations) to demonstrate via dispersion modeling that emissions of TAP from this source will not cause a concentration of TAP that exceeds the listed limits for ambient air at or beyond the property line of the source.

*This BGS is a fuel burning source burning only “virgin” fuels; therefore, Standard 8 does not apply.*

### 3.4 Applicability of Air Pollution Regulations to Proposed Construction/Modification

Table 3-1 contains a listing of the proposed modifications applied for and the applicability of the various air pollution regulations to the proposed modifications.

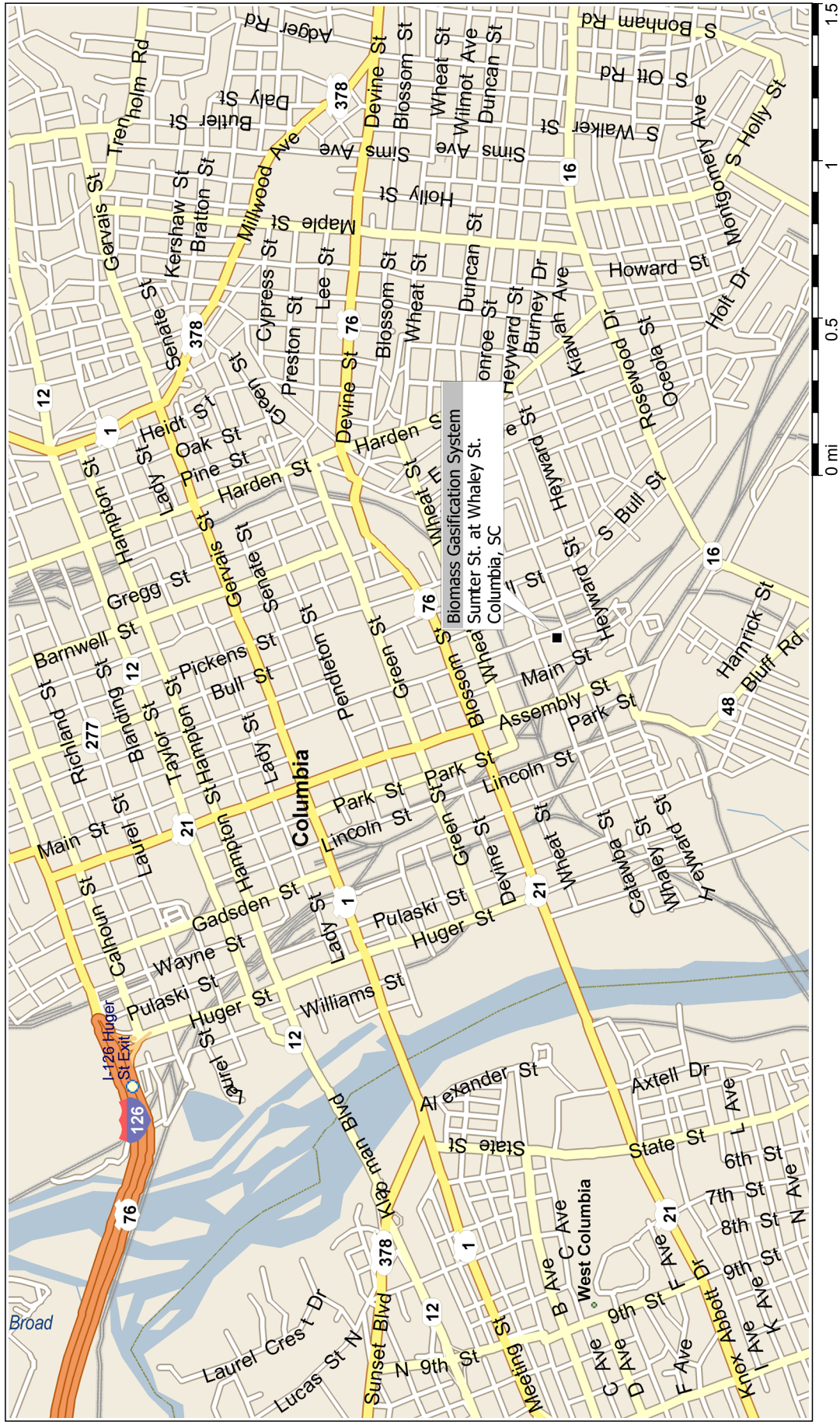
Table 3-1, Summary of Applicable Regulations

PROJECT	REGULATION	APPLY?	EXPLANATION
Installation of ESP on Biomass Gasification System	40 CFR 60	Yes	Subpart Dc PM and Opacity limits apply. COM is required.
	40 CFR 63	No	This new construction is not subject to a specific NESHAP.
	40 CFR 64	No	Uncontrolled PTE is less than major source thresholds.
	SC 61-62.5, Std. 1	Yes	PM, SO <sub>2</sub> and Opacity limits apply. PM limit is superceded by 40CFR60 Subpart Dc.
	SC 61-62.5, Std. 2	Yes	Compliance with AAQS has already been demonstrated using dispersion modeling.
	SC 61-62.5, Std. 3	No	No waste burning occurs in this process.
	SC 61-62.5, Std. 3.1	No	No medical waste incineration occurs in this process.
	SC 61-62.5, Std. 4	No	Subject to Standard 1 and 40CFR60 Subpart Dc instead.
	SC 61-62.5, Std. 5	No	Post 1980 installation.
	SC 61-62.5, Std. 5.1	No	No net VOC increase of 100 tpy since 1979.
	SC 61-62.5, Std. 5.2	Yes	NO <sub>x</sub> BACT already established at 0.2 lb/10 <sup>6</sup> Btu heat input.
	SC 61-62.5, Std. 6	No	No "Bubble" is being requested at this time.
	SC 61-62.5, Std. 7	Yes	Synthetic minor limits already established.
	SC 61-62.5, Std. 8	No	Fuel burning sources are not subject to Standard 8.
	SC 61-62.6	No	No fugitive dust emissions are expected
	SC 61-62.63	No	No new emissions of HAP will be emitted at major source levels from this project.
	SC 61-62.68	No	No 112(r) listed substances will be stored at above threshold levels for this project.
	SC 61-62.70	Yes	This facility already operates as a Title V source. This change will be incorporated into the Title V permit in accordance with Regulation 61-62.70 requirements.

## **EXHIBIT 1**

### **LOCATION MAP**

# LOCATION MAP - USC BIOMASS GASIFICATION SYSTEM

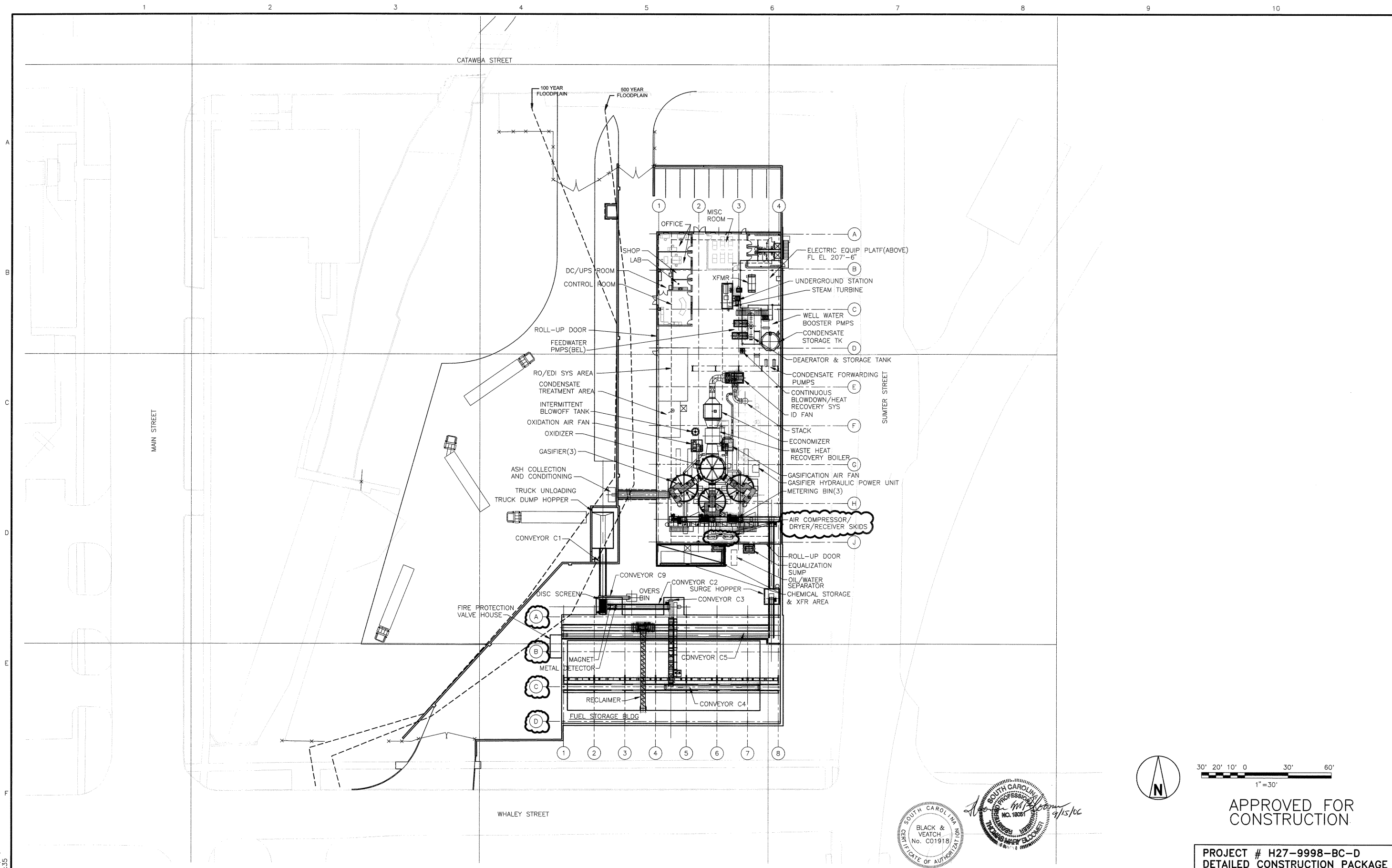


## **EXHIBIT 2**

### **PLOT PLAN**



MC011196 ACAD 15.05  
ASLE015  
09/15/06 08:33:35



30' 20' 10' 0 30' 60'  
1"=30'

APPROVED FOR  
CONSTRUCTION

PROJECT # H27-9998-BC-D  
DETAILED CONSTRUCTION PACKAGE

PROJECT DRAWING NUMBER  
137120-CBSA-G1000\_1 1

CODE  
AREA

I HEREBY CERTIFY THAT THIS DOCUMENT WAS  
PREPARED BY ME OR UNDER MY DIRECT SUPER-  
VISION AND THAT I AM A DULY REGISTERED PRO-  
FESSIONAL ENGINEER UNDER THE LAWS OF THE  
STATE OF SOUTH CAROLINA  
SIGNED TOM BLOOMER  
DATE 09/15/2006 REG NO. 15051

BLACK & VEATCH  
ENGINEER TMB DRAWN WKM  
CHECKED BDS DATE 09/15/06

JOHNSON CONTROLS INC.  
USC BIOMASS ENERGY PLANT  
SITE ARRANGEMENT

NO	DATE	REVISIONS AND RECORD OF ISSUE
1	09/15/2006	APPROVED FOR CONSTRUCTION
0	05/12/2006	ISSUED FOR PERMIT

## **APPENDIX A - SC DHEC PERMIT APPLICATION FORMS**



**Part I Permit Application Form**  
**Bureau of Air Quality**

**Please Refer To Instructions On Back Before Completing This Form**

1. Air Permit Number for Existing Plant: 1900-0143
2. Company Name for Permit: USC Environmental Health & Safety
3. Mailing Address: 306 Benson School  
City: Columbia State: SC Zip Code: 29208
4. Plant Location (Street or Highway): NW Corner of Sumter Street and Whaley Street  
City: Columbia State: SC Zip Code: 29208 County: Richland
5. Person to Contact: Thomas Syfert Phone No: ( 803 ) 777-5269
6. Standard Industrial Classification (SIC) Code for Plant: 8221
7. Attach the following applicable part(s) for each emission source:
- A. Number of Fuel Burning Applications (Part IIA): \_\_\_\_\_
- B. Number of Process Applications (Part IIB): 1
- C. Number of Incinerator Applications (Part IIC): \_\_\_\_\_
- D. Number of Asphalt Plant Applications (Part IID): \_\_\_\_\_
- E. Number of Dry Cleaner Applications (Part IIE): \_\_\_\_\_
- F. Number of Concrete Batch Plant Permit Applications (Part IIF): \_\_\_\_\_
- G. Number of Storage Vessel Permit Applications (Part IIG/Part IIGa): \_\_\_\_\_
8. **Application Type:** ☐ Operating Renewal Existing Sources Construction Date: \_\_\_\_\_  
☒ **NEW Construction** Start Date: 3/15/2007 Finish Date: 3/31/2007

**9. Signatures:**

I certify, to the best of my knowledge and belief, that no undesirable levels of air pollutants will be created and no applicable standards and/or regulations will be contravened or violated. I understand that any statements and/or descriptions which are found to be incorrect may result in the immediate revocation of any permit issued pursuant to this application.

_____	_____	_____
Company Official Signature	EHS Director Title/Position	Date

I have placed my signature and seal on the engineering documents submitted, signifying that I accept responsibility for the accuracy of this application as it pertains to DHEC Air Pollution Regulation 61-62.

_____	<u>21585</u>	_____
Professional Engineer Signature	S.C. Registration No.	Date

If the consultant or professional engineer that prepared this application desires a copy of issued permit(s), please complete the information below.

Name/Consulting Firm: CT&EE, Inc

Address: 200 Davidson Road City: Columbia

State: SC Zip Code: 29609 Phone No.: (864) 313-9432

**\*\*\*INCOMPLETE APPLICATIONS WILL BE RETURNED\*\*\***



**Process Permit Application  
Bureau of Air Quality  
Part IIB**

1. Company Name: **USC Environmental Health and Safety**

Process Description: Electrostatic Precipitator for Biomass Gasification System SIC/NAICS Code: 8221

Process Unit Designation: ESP for Biomass Gasification System (1900-0143-CH)  
PPC Industries, Model **11R-1220-2712P**

2. Major Raw Materials: NA

Quantity Used:

Products:

Rated Production:

**3. Fuel Data (include all units)**

Fuel Type and Grade	BTU Content	% Sulfur by weight	% Ash by weight	Consumption @ rated capacity

4. Air Pollution Control Device Description: ESP

**5. Stack Data:**

Height Above Ground (ft)	Inside Diameter (ft)	Est. Moisture (%)	Gas Velocity (ft/sec)	Temperature (°F)	Location (UTM or Lat./Long)
93	4	4	74	315	N 33.9888 W 81.0265

**6. Emission Rate at Rated Capacity (lb/hr.):**

Pollutant	Before Control Device	After Control Device	Method of Estimating Emissions
Particulate Matter	8.96	<2.28	Similar Unit Test, Kamloops, B.C. & Engr. Calc.
SO <sub>2</sub>	4.86	4.86	Similar Unit Test, Kamloops, B.C.
CO	11.23	11.23	Similar Unit Test, Kamloops, B.C.
NO <sub>x</sub>	21.6	21.6	Similar Unit Test, Kamloops, B.C.
VOCs	11.23	11.23	Similar Unit Test, Kamloops, B.C.
Other (specify): PM <sub>10</sub>	4.86	<2.28	Similar Unit Test, Kamloops, B.C. & Engr. Calc.

7. Are any materials subject to provisions of the SC Hazardous Waste Management Act or Regulations? (specify): No

8. Normal Operating Schedule: 24 hours/day 7 days/week 52 weeks/yr

Seasonal Variation: Dec-Feb 35 %      Mar.-May 25 %      June-Aug. 15 %      Sept-Nov. 25 %

9. How will waste material from process and control equipment be disposed of? *Per State and Federal Rules*



**AIR DISPERSION MODELING QUESTIONNAIRE**  
**Bureau of Air Quality**

COMPANY NAME \_\_\_\_\_

PERMIT NUMBER \_\_\_\_\_

STACK DESIGNATION (NAME) \_\_\_\_\_

POLLUTANT/AIR TOXIC EMITTED \_\_\_\_\_

CAS NO. (FOR AIR TOXICS ONLY) \_\_\_\_\_

EMISSION RATE (lb/hr) \_\_\_\_\_

PROCESS NAME (if applicable) \_\_\_\_\_

DATE INSTALLED/MODIFIED \_\_\_\_\_

HEAT INPUT ( $10^6$  BTU/hr) (if applicable) \_\_\_\_\_

FUEL(S) USED, INCLUDE BACKUPS (if applicable) \_\_\_\_\_

STACK HEIGHT ABOVE GROUND (ft) \_\_\_\_\_

DOES STACK HAVE A RAIN CAP OR IS DISCHARGE HORIZONTAL \_\_\_\_\_

STACK DIAMETER (i.d.) (ft) \_\_\_\_\_

UTM's OR LATITUDE/LONGITUDE OF STACK \_\_\_\_\_

STACK TEMPERATURE (deg. F) \_\_\_\_\_

STACK VELOCITY (ft/sec) \_\_\_\_\_

DISTANCE FROM STACK TO NEAREST PLANT BOUNDARY (ft) \_\_\_\_\_

BUILDING LENGTH<sup>1</sup> (ft) \_\_\_\_\_

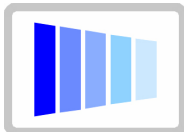
BUILDING WIDTH<sup>1</sup> (ft) \_\_\_\_\_

BUILDING HEIGHT<sup>1</sup> (ft) \_\_\_\_\_

<sup>1</sup> If there are several buildings near the stack, include a plot plan showing stack location as well as length, width and height of nearby buildings. See back of form for additional information.

**See instructions on the reverse side of this form.**

## **APPENDIX B – SPECIFICATIONS AND FLOW DIAGRAMS**



## PPC Industries

3000 East Marshall  
903-758-3395

Longview, TX 75601  
Fax 903-758-6487

No. 06223, Rev. 3a -kd

Date: 11/28/06

### Johnson Controls, Inc.

9844-B Southern Pines Blvd.  
Charlotte, NC 28273

Delivery: See Sect. V.

F.O.B. Jobsite

Attention: Mr. Kenneth Detwiler  
Email: [kenneth.w.detwiler@jci.com](mailto:kenneth.w.detwiler@jci.com)  
Phone: 704/521-6286

Page 1 of 11

Reference: Your Inquiry of 10/03/06  
Outlet nozzle revised to vertical discharge,  
stack adapter added, option added for DCSi

Contact: Gerry Graham

---

We are pleased to offer you the following for one of our modular electrostatic precipitators for your wood fired gasifier to be located at Columbia, SC.

### I. DESIGN BASIS

Volume (ACFM) .....	55,800
Temperature (° F).....	318
H <sub>2</sub> O in flue gas (% by vol.) .....	15 (est.)
Inlet to precipitator (lbs/hr) .....	15
Emission rate (lbs/MMBTU) .....	0.025
Dust source .....	wood fired gasifier
Fuel .....	wood waste
Power voltage/frequency.....	480 / 3 phase / 60 hz
Control voltage/frequency .....	120 / 1 phase / 60 hz

### II. SCOPE OF WORK BY PPC INDUSTRIES

**PRECIPITATOR:** PPC is offering one Model **11R-1220-2712P** modular electrostatic precipitator including all collecting plates, rigid discharge electrodes, roof sections, insulator compartments, access doors, all internal components and power supplies to make a complete air pollution control assembly.

The electrostatic precipitator will have the following design features:

Gas velocity (ft/sec).....	4.23
Treatment time (seconds) .....	4.8
Aspect ratio (treatment length/treatment height) .....	1.02
Treatment length (feet).....	20.4
Collecting area (square feet).....	8,983
SCA (sq. ft./1,000 acfm).....	161.0
Power consumption (kw).....	33
Pressure drop (inches of wc) .....	0.50
Structural design temp. (° F.).....	700
Hopper capacity (cubic feet) .....	962
Number of gas passages .....	11
Spacing of gas passages (inches) .....	12
Number of discharge electrodes .....	154
Lineal feet of discharge electrodes .....	3,080

Transformer output voltage (kv).....	55
Transformer output current (ma).....	300
Installed weight (excluding dust, insulation, and support steel).....	96,500

The collecting plates will be a new heavier constructed style from solid rolled steel sheets not less than 18 gauge. The sheets have a new more rigid box style stiffening fin and baffled to give quiet gas areas at the surface of the plate to minimize re-entrainment. Both top and bottom alignment guides, stiffeners and mountings will maintain the alignment of plates while permitting thermal expansion. The plates will be designed for a maximum temperature excursion to 700° F.

Electromagnetic uplift-gravity impact rappers will be provided. The rapping systems will be arranged to operate automatically and will be designed to minimize particulate re-entrainment. The rapper control will have adjustable frequency and intensity features.

Rigid electrodes will be provided and they will be fabricated from 16 gauge seamless tubing with uniformly spaced corona emitting pins welded to the tubing. The electrodes will be stabilized and supported to maintain alignment at all temperature ranges of the precipitator's operation.

Each discharge electrode frame will be vibrated individually and the system will be designed such that both duration and frequency of vibration can be varied.

Two step up transformers/rectifiers will be provided with the precipitator. Each set will be an outdoor type, oil insulated, self-air cooled unit with full-wave rectifiers. The transformer and rectifiers will be in the same tank. The transformer will be provided with a grounding switch and a key interlock. Each set will be rated for temperature rise of 45° C (at a maximum ambient of 50° C).

The high tension support insulators will be of the cylindrical, compression load type. The insulators will be porcelain, glazed inside and outside and will have ground ends. The insulators will be located out of the gas treatment area, and will be kept clean by purge air.

The precipitator will be furnished with key type safety interlocks with a sequential key arrangement to prevent access to any high voltage equipment without locking out the power supply and grounding the high voltage equipment. The following equipment will be interlocked: all quick opening precipitator access doors, transformer/rectifier ground switches and high voltage control unit circuit breakers.

Welded weatherproof individual insulator compartments will be provided to house insulators. The insulator compartments will be accessible by access doors with safety interlocks to prevent access to all high voltage areas except until the precipitator is de-energized and grounded.

The electrostatic precipitator shell will be fabricated from 3/16" thick ASTM A-36 steel plate with external ASTM A-36 structural stiffeners as required to support the electrostatic precipitator pressure, wind, live, and dead loads. The shell will be seal welded to form a totally gas tight structure.

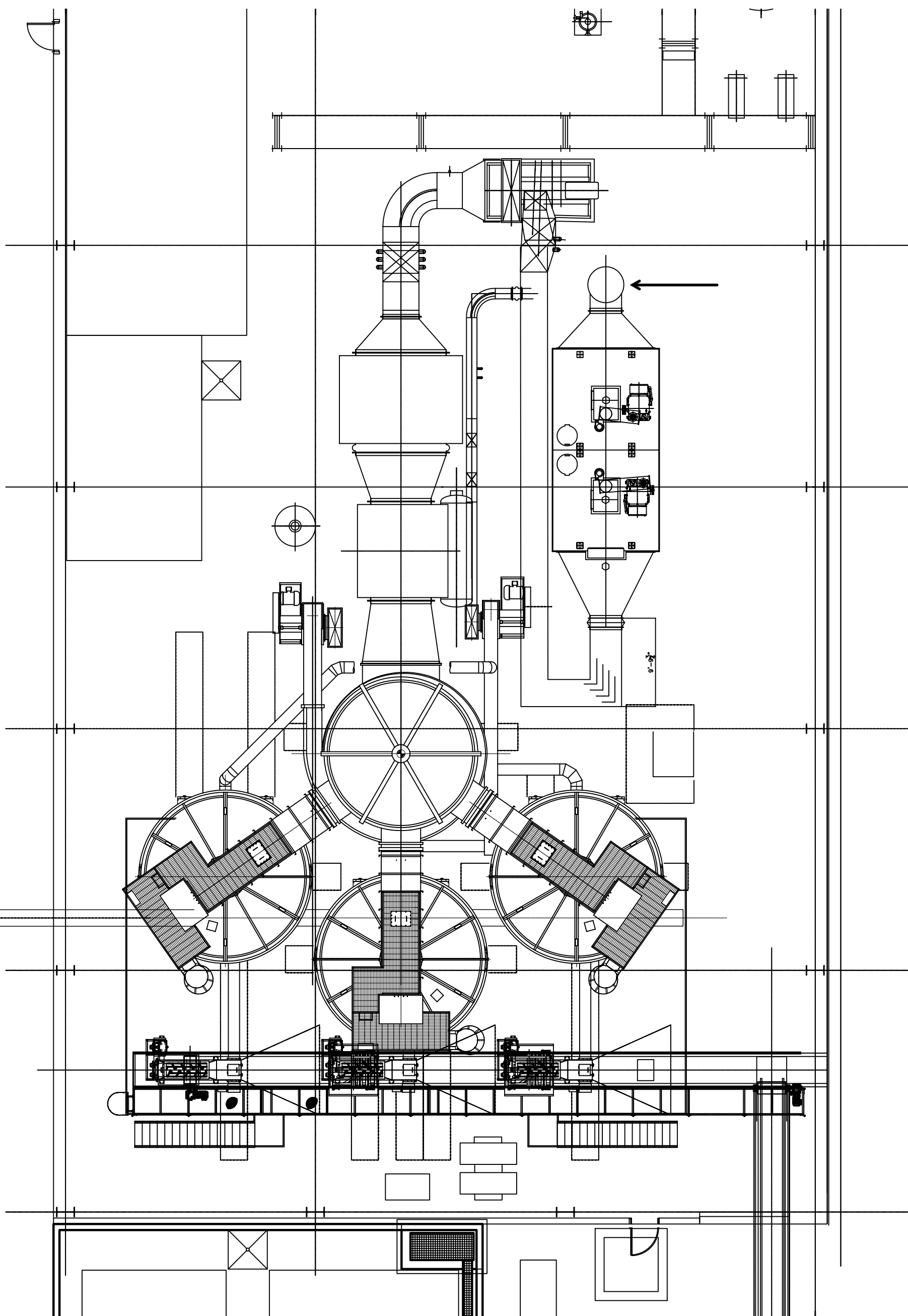
The precipitator will be equipped with two transverse trough type hoppers. Each hopper will be fabricated from 3/16" ASTM A-36 steel plate, and supported with ASTM A-36 external structural shapes as required to support the hopper loads. Each hopper will be designed to support its weight when full of particulate. Particulate density is 65 lb/cu.ft. for structural sizing and 45 lb/cu.ft. for hopper capacity sizing. In addition, the hoppers will be of sufficient capacity to store particulate collected over a minimum period of 12 operating hours. The sides will be sloped to provide a minimum hopper wall angle of 60° from the horizontal. The end angle will be adjusted to insure a minimum hopper valley angle of 55°. The discharge opening will be 18" wide x 6'-0". Each hopper will be equipped with the following accessories.

**Access and Poke Holes:** Each hopper will have a quick opening, key interlocked access door and a three (3) inch diameter poke hole.

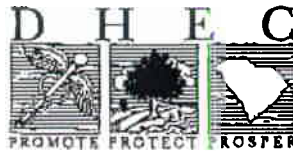
**Hopper Hammer Pads:** A vibrator pad will be provided on one side of each hopper. The pad will be drilled to accommodate a vibrator for future mounting by purchaser if required to enhance dust removal.

**Heaters:** PPC will shop install 2.5 kw, 480 volt, single phase, 60 HZ, electrical heaters on each





**APPENDIX C – BGS CONSTRUCTION PERMIT AND BAQ  
ENGINEERING CALCULATION SHEETS**



C. Earl Hunter, Commissioner

*Promoting and protecting the health of the public and the environment.*

**OFFICE OF ENVIRONMENTAL QUALITY CONTROL  
BUREAU OF AIR QUALITY  
NSPS / SYNTHETIC MINOR CONSTRUCTION PERMIT**

University of South Carolina (USC) Environmental Health & Safety  
306 Benson School (Corner of Sumter and Whaley Streets)  
Columbia, SC 29208

Permission is hereby granted to install a Biomass Gasification System, consisting of three (3) 36 million Btu/hr gasifiers each with a 5 million Btu/hr natural gas fired burner, an oxidizer, a heat recovery steam boiler, a 1,500 kW steam turbine, and a electrical generator, as outlined below:

**Gasifiers:** The gasification process will be utilizing untreated wood waste only, and under oxygen deprived circumstances generate synthetic gas (syn gas), at temperatures of 700 degrees F. The natural gas fired burners will be utilized at normal and non-routine startup in order to heat the refractory lining of the gasifiers and oxidizer, prior to starting the gasification process. The ash generated will be removed and sent to landfills.

**Oxidizer:** The syn gas will be fully combusted, with added combustion air, in the oxidizer, which will result in the generation of flue gas. This process is based on auto-ignition, however, based on the maximum input of syn gas and oxygen the oxidizer has a heat input of 76 million Btu/hr. The Oxidizer is subject to NSPS, Subpart A – General Provisions and Subpart Dc - Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units.

**Boiler:** The flue gas enters the boiler at temperatures around 1,900 degrees F, and is utilized to generate high-pressure steam. There is no combustion associated with the boiler. The Boiler is subject to NSPS, Subpart A – General Provisions and Subpart Dc - Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units.

**Steam Turbine and Electrical Generator:** The high-pressure steam from the boiler is utilized to generate low-pressure saturated steam for the campus and electrical power for the biomass plant and campus.

The Biomass gasification System is considered a Fuel Conversion Plant and subject to a less than 100 TFY limit for SO<sub>2</sub>, NO<sub>x</sub> and CO, to avoid SC Regulation 62.5, Standard 7 – Prevention of Significant Deterioration.

**NOTWITHSTANDING ANY OF THE CONDITIONS LISTED BELOW, NO APPLICABLE LAW, REGULATION, OR STANDARD MAY BE VIOLATED.**

**PERMIT NUMBER:** 1900-0143-CH

**PLANT LOCATION:** 306 Benson School (Corner of Sumter and Whaley Streets) - Columbia

**DATE OF ISSUE:** August 16, 2005

**FACILITY SIC/NAICS CODES:** 8221/611310

SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL  
2600 Bull Street • Columbia, SC 29201 • Phone: (803) 898-3432 • [www.scdhec.net](http://www.scdhec.net)

**USC Environmental Health and Safety**  
**CONSTRUCTION PERMIT NUMBER: 1900-0143- CH**  
**DATE OF ISSUE: August 16, 2005**  
**Page 2 of 7**

**CONDITIONS**

1. All official correspondence, plans, permit application forms, and written statements are an integral part of this permit.
2. **THE DIRECTOR OF THE ENGINEERING SERVICES DIVISION MUST BE NOTIFIED IN WRITING OF THE DATE CONSTRUCTION BEGAN POSTMARKED NO LATER THAN 30 DAYS AFTER SUCH DATE, AND THE ACTUAL DATE OF STARTUP POSTMARKED WITHIN 15 DAYS AFTER SUCH DATE OF EACH PERMITTED FACILITY.**
3. This construction permit shall expire one year from date issued. This permit may be extended one year upon approval by the Bureau following the written request from the permittee. This request must be made prior to the permit expiration.
4. An expired construction permit may be reactivated within one year of the expiration only upon approval by the Bureau following the written request of the permittee. This request shall address all laws, regulations, and standards applicable at the time of request for reactivation.

This is pursuant to the provisions of Section 48-1-110, 1976 *Codes of South Carolina*, as amended, and the *South Carolina Air Quality Control Regulation 61-62.1*, Section II and the *Code of Federal Regulations*, Title 40, Part 60, Subpart A.

**I. STANDARD CONDITIONS**

- A. This permit expressly incorporates all the provisions of *South Carolina Department of Health and Environmental Control Regulation 61-62.1*, Section II, Paragraph C and the *Code of Federal Regulations*, Title 40, Part 60, Subpart A.

**II. SPECIAL CONDITIONS**

**A. EMISSION LIMITATIONS**

Air pollutant emissions shall not exceed the following:

ID	Pollutant/ Standard	Limit	Reference Method	Regulation	State Only
CH (Boiler and Oxidizer only are subject to NSPS, part Dc)	Opacity	20%	9	40 CFR 60.43c and 40 CFR 60.47c(a)	No
CH (Biomass Gasification System)	Opacity	20%	9	SC Regulation 61-62.5, Standard 1, Section I	No
CH (Biomass Gasification System)	PM	0.6 lb/million Btu heat input	5	SC Regulation 61-62.5, Standard 1, Section I	No

**USC Environmental Health and Safety**  
**CONSTRUCTION PERMIT NUMBER: 1900-0143- CH**  
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ID	Pollutant/ Standard	Limit	Reference Method	Regulation	State Only
(Biomass Gasification System) CH	SO <sub>2</sub>	3.5 lb/million Btu heat input	6	SC Regulation 61-62.5, Standard 1, Section I	No
(Biomass Gasification System) CH	PM	0.1 lb/million Btu heat input	5	40 CFR §60.43c(b)(1)	No
(Biomass Gasification System) CH	NO <sub>x</sub>	0.2 lb/million Btu heat input	5	SC Regulation 61-62.5, Standard 5.2, Section III, Table 1 - NO <sub>x</sub> Control Standards	No
(Biomass Gasification System) CH	SO <sub>2</sub> , NO <sub>x</sub> and CO	Less than 100 TPY (each)	As Approved By BAQ	SC Regulation 61-62.1, Section II(H)	No

N/A = Not Applicable

The emission limitations listed for each emission unit are based on operation at permitted capacity. Operation at less than permitted capacity must meet emission limits specified in the applicable regulations based on that operating rate. All test methods must be the most recent revisions that are published in the *Code of Federal Regulations*, in accordance with the requirements of SC Regulation 61-62.1, Section IV, Source Test.

**B. CONTINUOUS MONITORING REQUIREMENTS**

ID	Pollutant	Averaging Time
CH (Boiler)	PM	6-minute

**C. SOURCE TEST SCHEDULE**

ID	Pollutant	Frequency	Method
CG (Biomass Gasification System)	PM, PM <sub>10</sub> , SO <sub>2</sub> , NO <sub>x</sub> , CO and VOC	Initial source test only.	201 or 201A for PM <sub>10</sub> , 6 or 6C for SO <sub>2</sub> , 7 or 7E for NO <sub>x</sub> , 10 for CO, 25 or 25A for VOC

**D. ADDITIONAL CONDITIONS**

Condition Number	Conditions
1.	The permittee shall pay fees in accordance with SC Regulation 61-30, SC Environmental Protection Fees.



**USC Environmental Health and Safety**  
**CONSTRUCTION PERMIT NUMBER: 1900-0143- CH**  
**DATE OF ISSUE: August 16, 2005**  
**Page 4 of 7**

Condition Number	Conditions
2.	<p>In accordance with SC Regulation 61-62.1 Section II(C)(3), for all sources not required to have continuous emissions monitors, in the event of any malfunction of air pollution control equipment or system, process upset or other equipment failure which results in discharges of air contaminants lasting for one hour or more and which are greater than those discharges described for normal operation in the permit application shall be reported to the local Environmental Quality Control (EQC) District office within twenty-four (24) hours after the beginning of the occurrence. The permittee shall also submit a written report within thirty (30) days of the occurrence. This report shall be submitted to the Manager of the Technical Management Section, Bureau of Air Quality (BAQ). The report shall contain as a minimum, the following: the identity of the emission unit and associated equipment where excess emissions occurred, the magnitude of excess emissions, the time and duration of excess emissions, the steps taken to remedy the malfunction and to prevent a recurrence, documentation that control equipment and processes were at all times maintained and operated, to the maximum extent practicable, in a manner that was consistent with good practice for minimizing emissions. Such a report shall in no way serve to excuse, otherwise justify, or in any manner affect any potential liability or enforcement action resulting from the occurrence.</p>
3.	<p>Air dispersion modeling (or other method) has demonstrated that this facility's operation will not interfere with the attainment and maintenance of any state or federal standard. Any changes in the parameters used in the air dispersion modeling may require a review by the facility to determine continuing compliance with these standards. These potential changes include any decrease in stack height, decrease in stack velocity, increase in stack diameter, decrease in stack exit temperature, increase in building height or building additions, increase in emission rates, decrease in distance between stack and property line, changes in vertical stack orientation, and installation of a rain cap that impedes vertical flow. Parameters that are not required in the determination will not invalidate the demonstration if they are modified. The emission rates used in the determination are listed in Attachment A of this permit. Higher emission rates may be administratively incorporated into Attachment A of this permit provided a demonstration using these higher emission rates shows the attainment and maintenance of any state or federal standard or with any other applicable requirement. Variations from the input parameters in the demonstration shall not constitute a violation unless the maximum allowable ambient concentrations identified in the standard are exceeded.</p> <p>The owner/operator shall maintain this facility in compliance with the pollutant limitations in Section II(A) - Emissions Limitations, and/or as listed in Attachment A of this construction permit, whichever is more restrictive. This is a State Only enforceable requirement. Should the facility wish to increase the emission rates listed in Attachment A, it may do so by the administrative process specified in this permit condition.</p>
4	<p>These conditions shall not supersede any State or Federal requirements such as National Emission Standards for Hazardous Air Pollutants, unless these conditions would impose a more restrictive limit.</p>
5	<p>This construction permit was reviewed and issued based on the permit application submitted by the owner/operator. The owner/operator shall obtain any Bureau authorization required under South Carolina Regulation 61-62.1, Section II(A)(1) prior to making modifications not covered under this construction permit.</p>
6	<p>This source shall be inspected by a Bureau of Air Quality representative in order to assure compliance with the conditions of this permit and all applicable regulations before an Operating Permit can be issued.</p>

**USC Environmental Health and Safety**  
**CONSTRUCTION PERMIT NUMBER: 1900-0143- CH**  
**DATE OF ISSUE: August 16, 2005**  
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Condition Number	Conditions
7	The owner/operator of this facility must submit a written request to obtain an operating permit to the Director of Engineering Services Division at least fifteen (15) days prior to placing this source into operation. The facility shall also meet the requirements as specified in SC Regulation 61-62.70.7(e).
8	In accordance with SC Regulation 61-62.5, Standard No. 1 - Emissions from Fuel Burning Operations, Section II - Particulate Matter Emissions, the allowable discharge of particulate matter resulting from the fuel burning operations is 0.6 lbs/10 <sup>6</sup> BTU input.
9	In accordance with SC Regulation 61-62.5, Standard No. 1 - Emissions from Fuel Burning Operations, Section III - Sulfur Dioxide Emissions, the maximum allowable discharge of SO <sub>2</sub> resulting from the fuel burning operations is 3.5 lbs/10 <sup>6</sup> BTU input.
10	In accordance with SC Regulation 61-62.5, Standard No. 5.2 - Control Of Oxides Of Nitrogen (NOx), Section III, Table 1 - NOx Control Standards, the allowable discharge of particulate matter resulting from the fuel burning operations is 0.2 lbs/10 <sup>6</sup> BTU input.
11	The Biomass Gasification System is permitted to burn only untreated wood waste as fuel. The use of any other substances as fuel is prohibited without prior written approval from the Bureau of Air Quality.
12	<p>The Boiler must demonstrate simultaneous compliance with requirements A and B and associated recordkeeping as detailed below.</p> <p>A. In accordance with SC Regulation 61-62.5, Standard No. 1, Section I(B), the boiler shall not discharge into the ambient air smoke which exceeds an opacity of 20%. During times of soot blowing the opacity may be exceeded for a total of 6 minutes in any hour or 24 minutes in any 24-hour period, but shall in no case exceed an opacity of 60%.</p> <p>B. In accordance with 40 CFR 60.42a(b), these sources shall not discharge into the ambient air smoke, which exceeds an opacity of 20% except for one six-minute (6) period per hour of not more than 27% opacity.</p> <p>The opacity standards set forth above do not apply during startup or shutdown. The owner/operator shall, to the extent practicable, maintain and operate any source including associated air pollution control equipment in a manner consistent with good air pollution control practices for minimizing emissions. In addition, the owner/operator shall, for a period of at least five (5) years maintain a log of the time, magnitude, duration and any other pertinent information to determine periods of startup and shutdown and make these records available to a Department representative upon request.</p>
13	(Boiler and Oxidizer) New Source Performance Standard (NSPS 40 CFR 60), Subpart A, General Conditions and Subpart Dc, Small Industrial - Commercial - Institutional Steam Generating Units, for which Construction, Reconstruction or Modification Commenced after June 9, 1989, applies to the Boiler and Oxidizer only. The permittee shall comply with all applicable parts of Subparts A and Dc.

**USC Environmental Health and Safety**  
**CONSTRUCTION PERMIT NUMBER: 1900-0143- CH**  
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Condition Number	Conditions
14.	(Boiler) The owner or operator shall record and maintain records of the amounts and types of each fuel combusted by the Biomass Gasification System. The amount and type of fuel combusted shall be recorded daily, and maintained on site for a period of at least five (5) years from the date generated. All records shall be made available to Department personnel upon request.
15.	(Boiler) In accordance with 40 CFR §60.43c(b)(1), the allowable discharge of particulate matter resulting from the fuel burning operations is 0.1 lbs/10 <sup>6</sup> BTU input.
16.	(Boiler) As per 40 CFR §60.47c(a) the owner or operator of an affected facility combusting wood that is subject to the opacity standards under §60.43c shall install, calibrate, maintain, and operate a continuous opacity monitoring system (COMS) for measuring the opacity of the emissions discharged to the atmosphere and record the output of the system. The COMS shall be monitored based on a 6-minute averaging time.
17.	Within 180 days after the startup date of Biomass Gasification System, the owner/operator shall perform an initial source test of the system, in order to verify and record the emission rates of PM, PM <sub>10</sub> , SO <sub>2</sub> , NO <sub>x</sub> , CO and VOC. No further source testing will be required, unless the Bureau deems it to be necessary. The source tests shall be conducted while the facility is operating at the maximum expected production rate or other production rate or operating parameter, which would result in the highest emissions for the pollutants being tested. Source tests conducted under any other conditions may result in production limitations. The owner or operator shall ensure that the source tests are conducted in accordance with requirements listed in SC Regulation 61-62.1, Section IV, Source Tests. This Bureau must be notified at least two weeks prior to any source test so that a Bureau representative may be present. Source test methodology must be approved by this Bureau.
18.	(CH) As per SC Regulation 61-62.1, Section II(H), the owner/operator is permitted to emit SO <sub>2</sub> , NO <sub>x</sub> and CO at less than 100 tons per year (each), for the Biomass Gasification System. SO <sub>2</sub> , NO <sub>x</sub> and CO emissions shall be calculated on a monthly basis, and a twelve-month rolling sum shall be calculated for total SO <sub>2</sub> , NO <sub>x</sub> and CO emissions. The twelve-month rolling sum shall remain below 100 tons for each of the following pollutants SO <sub>2</sub> , NO <sub>x</sub> and CO. The owner/operator shall maintain all records, including material purchase orders, invoices, and material data sheets, etc. for a period of at least five (5) years from the date generated, and shall make these records available to Department personnel upon request. Semi-annual reports including all recorded parameters and calculated values shall be submitted to the Manager of the Technical Management Section, Bureau of Air Quality postmarked no later than 30 calendar days after the end of the reporting period. An algorithm, including example calculations and emission factors, explaining the method used to determine SO <sub>2</sub> , NO <sub>x</sub> and CO rates shall be included in the initial report. Subsequent submittals of the algorithm and example calculations are unnecessary, unless the method of calculation is found to be unacceptable by the Bureau or if the facility changes the method of calculating emissions and/or changes emission factors.



**USC Environmental Health and Safety**  
**CONSTRUCTION PERMIT NUMBER: 1900-0143- CH**  
**DATE OF ISSUE: August 16, 2005**  
**Page 7 of 7**

Condition Number	Conditions
19	(Facility Wide) As per SC Regulation 61-62.1, Section II(H), the owner/operator is permitted to emit SO <sub>2</sub> , NO <sub>x</sub> and CO at less than 250 tons per year (each), facility wide. SO <sub>2</sub> , NO <sub>x</sub> and CO emissions shall be calculated on a monthly basis, and a twelve-month rolling sum shall be calculated for total SO <sub>2</sub> , NO <sub>x</sub> and CO emissions. The twelve-month rolling sum shall remain below 250 tons for each of the following pollutants SO <sub>2</sub> , NO <sub>x</sub> and CO. The owner/operator shall maintain all records, including material purchase orders, invoices, and material data sheets, etc. for a period of at least five (5) years from the date generated, and shall make these records available to Department personnel upon request. Semi-annual reports including all recorded parameters and calculated values shall be submitted to the Manager of the Technical Management Section, Bureau of Air Quality postmarked no later than 30 calendar days after the end of the reporting period. An algorithm, including example calculations and emission factors, explaining the method used to determine SO <sub>2</sub> , NO <sub>x</sub> and CO rates shall be included in the initial report. Subsequent submittals of the algorithm and example calculations are unnecessary, unless the method of calculation is found to be unacceptable by the Bureau or if the facility changes the method of calculating emissions and/or changes emission factors.

  
Carl W. Richardson, P.E., Director  
Engineering Services Division  
Bureau of Air Quality

**ATTACHMENT A**

**Modeled Emission Rates**  
**USC Environmental Health and Safety**  
**Permit No. 1900-0143-CH**  
**Page 1 of 1**

<b>AMBIENT AIR QUALITY STANDARDS - STANDARD 2</b>					
<b>STACK</b>	<b>Modeled Emission Rates (lbs/hr)</b>				
	<b>TSP</b>	<b>PM<sub>10</sub></b>	<b>SO<sub>2</sub></b>	<b>NO<sub>x</sub></b>	<b>CO</b>
West Plant Boiler No. 1 (33.475 MMBTU/hr)	0.79	0.57	16.98	4.78	2.678
West Plant Boiler No. 2 (54.48 MMBTU/hr)	1.28	0.895	27.63	7.78	4.49
East Plant Boiler No. 1 (33.475 MMBTU/hr)	0.805	0.805	17.24	8.31	2.34
East Plant Boiler No. 2 (33.475 MMBTU/hr)	0.805	0.805	17.24	8.31	2.34
East Plant Boiler No. 3 (33.475 MMBTU/hr)	0.805	0.805	17.24	8.31	2.34
South Plant Boiler No. 1 (30.32 MMBTU/hr)	0.71	0.5	15.38	4.33	2.5
South Plant Boiler No. 2 (30.32 MMBTU/hr)	0.71	0.5	15.38	4.33	2.5
BLR09 - Carolina Gardens Apts. Building No. 1 (2.31 MMBTU/hr)	0.0172	0.0172	0.0014	0.2265	0.1902
BLR13 14 - Arnold School of Public Health (10.2 MMBTU/hr, total)	0.152	0.152	0.012	2.0	1.68
BLR21 22 - Colonial Center (6.8 MMBTU/hr, total)	0.1013	0.1013	0.008	1.3333	1.12
BLR23 24 - Arnold School of Public Health (2.4 MMBTU/hr, total)	0.0358	0.0358	0.0028	0.4706	0.3953
HTR1 - Field House (2.187 MMBTU/hr)	0.0163	0.0163	0.0013	0.2144	0.1801
BIOGBS - Biomass Gasifier Boiler System	8.96	4.86	2.7	21.6	11.23
<b>FACILITY TOTAL</b>	<b>15.1876</b>	<b>10.0626</b>	<b>129.8155</b>	<b>71.9948</b>	<b>33.9836</b>

<b>DEFERRED NAAQS EMISSION RATES</b>					
<b>STACK</b>	<b>Modeled Emission Rates (lbs/hr)</b>				
	<b>TSP</b>	<b>PM<sub>10</sub></b>	<b>SO<sub>2</sub></b>	<b>NO<sub>x</sub></b>	<b>CO</b>
McMaster Boiler No. 1 (1.826 MMBTU/hr)	0.005	0.005	0.001	0.256	0.064
<b>FACILITY TOTAL</b>	<b>0.005</b>	<b>0.005</b>	<b>0.001</b>	<b>0.256</b>	<b>0.064</b>

<b>CLASS II PREVENTION OF SIGNIFICANT DETERIORATION - STANDARD 7</b>			
<b>STACK</b>	<b>Modeled Emission Rates (lbs/hr)</b>		
	<b>PM<sub>10</sub></b>	<b>SO<sub>2</sub></b>	<b>NO<sub>x</sub></b>
West Plant Boiler No. 1 (Installation 2003)	0.57	16.98	4.78
West Plant Boiler No. 2 (Installation 1988)	0.895	27.63	7.78
East Plant Boiler No. 1 (Installation April, 2002)	0.805	17.24	8.31
East Plant Boiler No. 2 (Installation April, 2002)	0.805	17.24	8.31
East Plant Boiler No. 3 (Installation April, 2002)	0.805	17.24	8.31
Old East Plant Boiler No. 1 (Installation 1967)	-0.7	-21.53	-6.06
Old East Plant Boiler No. 2 (Installation 1967)	-0.7	-21.53	-6.06
Old East Plant Boiler No. 3 (Installation 1974)	-0.9	-27.63	-7.78
Old West Plant Boiler No. 1 (Installation 1975)	-0.895	-27.63	-7.78
BLR09 - Carolina Gardens Apts. Building No. 1 (Installation 2001)	0.0172	0.0014	0.2265
BLR13 14 - Arnold School of Public Health (Installation 2004)	0.152	0.012	2.0
BLR21 22 - Colonial Center (Installation 2002)	0.1013	0.008	1.3333
BLR23 24 - Arnold School of Public Health (Installation 2004)	0.0358	0.0028	0.4706
HTR1 - Field House (Installation 1981)	0.0163	0.0013	--
BIOGBS - Biomass Gasifier Boiler System	4.86	2.7	21.6
<b>FACILITY TOTAL</b>	<b>5.8676</b>	<b>0.7355</b>	<b>35.4404</b>



## ENGINEERING CALCULATION SHEET

BAQ Engineering Services Division  
2600 Bull Street, Columbia, SC 29201  
Phone: 803-898-4123 Fax: 803-898-4079

<b>PROJECT/PROPOSAL NAME:</b>	USC Environmental Health and Safety	<b>PERMIT WRITER:</b>	Veronica Barringer
<b>LOCATION (STREET, CITY):</b>	Corner of Sumter and Whaley Street, Columbia	<b>DATE:</b>	8/16/05
<b>PERMIT NUMBER:</b>	1900-0143-CH	<b>Page 1 of 4</b>	
<b>SIC/NAICS CODE(S):</b>	8221/611310		

**DATE APPLICATION RECEIVED:** March 25, 2005

**DATE OF LAST INSPECTION:** November 20, 2003

### FACILITY DESCRIPTION

Facility is the University of South Carolina.

### PROJECT DESCRIPTION

Facility is requesting permission to install a new Biomass gasification system, consisting of three (3) 36 million Btu/hr gasifiers, each with a 5 million Btu/hr natural gas fired burner, an oxidizer, a heat recovery steam boiler, a steam turbine and a electrical generator. The gasification system is considered a fuel conversion plant for PSD purposes and will be given a less than 100 TPY limitation for SO<sub>2</sub>, NO<sub>x</sub> and CO, in order to remain synthetic minor for PSD. (Note that all criteria pollutants from the Biomass Gasification System are less than 100 TPY. However, facility wide the potential SO<sub>2</sub> and NO<sub>x</sub> emissions are above 250 TPY, and the potential CO emissions are above 100 TPY, hence these are the pollutants the facility will be required to keep track off).

### SOURCE DESCRIPTION

CP ID	Equip ID	Equipment Description	Installation Date	Stack ID
CH	Biomass Gasification System (Gasifiers, oxidizer, BLR-01)	<p>Biomass gasification system, consisting of three (3) 36 million Btu/hr gasifiers, each with a 5 million Btu/hr natural gas fired burner, an oxidizer, a heat recovery steam boiler, a 1,500 kW steam turbine and a electrical generator, as outlined below:</p> <p><u>Gasifiers:</u> The gasification process will be utilizing untreated wood waste only, and under oxygen deprived circumstances generate synthetic gas (syn gas), at temperatures of 700 degrees F. The natural gas fired burners will be utilized at normal and non-routine startup in order to heat the refractory lining of the gasifiers and oxidizer, prior to starting the gasification process. The ash generated will be removed and sent to landfills.</p> <p><u>Oxidizer:</u> The syn gas will be fully combusted, with added combustion air, in the oxidizer, which will result in the generation of flue gas. This process is based on auto-ignition, however, based on the maximum input of syn gas and oxygen the oxidizer has a heat input of 76 million Btu/hr. The Oxidizer is subject to NSPS, Subpart A – General Provisions and Subpart Dc - Standards Of Performance For Small Industrial-Commercial-Institutional Steam Generating Units.</p> <p><u>Boiler:</u> The flue gas enters the boiler at temperatures around 1,900 degrees F, and is utilized to generate high-pressure steam. There is no combustion associated with the boiler. The Boiler is subject to NSPS, Subpart A – General Provisions and Subpart Dc - Standards Of Performance For Small Industrial-Commercial-Institutional Steam Generating Units.</p> <p><u>Steam Turbine and Electrical Generator:</u> The high-pressure steam from the boiler is utilized to generate low-pressure saturated steam for the campus and electrical power for the biomass plant and campus.</p> <p>The Biomass gasification System is considered a Fuel Conversion Plant and subject to a less than 100 TPY limit for SO<sub>2</sub>, NO<sub>x</sub> and CO, to avoid SC Regulation 62.5, Standard 7 – Prevention of Significant Deterioration.*</p>	Future	BIOGBS

\*All criteria pollutants from the Biomass Gasification System are less than 100 TPY. However, facility wide the potential SO<sub>2</sub> and NO<sub>x</sub> emissions are above 250 TPY, and the potential CO emissions are above 100 TPY, hence these are the pollutants the facility will be required to keep track off.

### EMISSIONS

UNCONTROLLED POTENTIAL EMISSIONS				
ID	Pollutant	lb/hr	TPY@ 8760 hours	Method for Estimating Emissions
CH	PM	8.96	39.24	Data is based upon two test reports at the Nexterra plant at Kamloops B.C. The first performance test was done July 2004, with fuel containing less than 30% moisture. The second performance test was done December 2004, with fuel containing between 40-50%
CH	PM10	4.86	21.29	
CH	SO <sub>2</sub>	2.7	11.83	
CH	NO <sub>x</sub>	21.6	94.61	
CH	CO	11.23	49.19	



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UNCONTROLLED POTENTIAL EMISSIONS				
ID	Pollutant	lb/hr	TPY@ 8760 hours	Method for Estimating Emissions
CH	VOC	11.23	49.19	moisture.

FACILITY WIDE EMISSIONS				
Pollutant	Uncontrolled Emissions		Controlled Emissions	
	lb/hr	TPY@ 8760 hours	lb/hr	TPY@ 8760 hours
PM	15.17	66.45	--	--
PM10	10.05	43.99	--	--
SO2	129.82	568.59	--	--
NOx	71.77	314.35	--	--
CO	33.79	148.02	--	--
VOC	15.27	66.9	--	--

**Note:** Facility-wide emissions do not include emissions from exempted sources at the facility.

### REGULATIONS

SC Regulations 61-62.5, Standard 1 - Emissions from Fuel Burning Operations

Applicable The following Fuel Burning Operations have PM, SO<sub>2</sub>, and Opacity limits imposed by this standard:

ID	Opacity	PM Allowable (0.6 10 <sup>6</sup> BTU) lb/hr	SO <sub>2</sub> Allowable (3.5 lb/10 <sup>6</sup> BTU) lb/hr	Uncontrolled Emissions (lb/hr)	
				PM	SO <sub>2</sub>
CH	20% (each)	64.8 (total)	378 (total)	8.96	2.7

SC Regulations 61-62.5, Standard 2 - Ambient Air Quality Standards (AAQS) and SC Regulations 61-62.5, Standard 7, Section II - Prevention of Significant Deterioration (PSD), Ambient Air Limits

Applicable This facility has demonstrated compliance through modeling; see modeling summary dated 6/28/05. No operational restriction has been established to ensure compliance with the modeled emission rates.

This facility has demonstrated compliance through modeling for the PSD Class II increments for Richland County; see modeling summary dated 6/25/05.

SC Regulations 61-62.5, Standard 3 - Waste Combustion and Reduction (State Only)

Not Applicable This process does not contain waste combustion or reduction sources. The process will be allowed to burn only untreated wood waste.

SC Regulations 61-62.5, Standard 5.2 - Control of Oxides of Nitrogen (NO<sub>x</sub>)

Applicable Stationary source that emits or has the potential to emit NO<sub>x</sub> generated from fuel combustion constructed after 06/25/2004, is subject to Sections III & VI of this standard.

CP ID	Equipment ID	Installation date	Emission Limit (NO <sub>x</sub> )
CH	Biomass gasification system	Future	0.2 lb/million Btu heat input

SC Regulations 61-62.5, Standard 7 - Prevention of Significant Deterioration (PSD)

Biomass Gasification Project only:

Not Applicable The facility is a major source for PSD for the following pollutants: SO<sub>2</sub> and NO<sub>x</sub>. Note that this project in and of itself does not exceed 100 TPY of any regulated pollutants. All criteria pollutants from the Biomass Gasification System are less than 100 TPY. However, facility wide the potential SO<sub>2</sub> and NO<sub>x</sub> emissions are above 250 TPY, and the potential CO emissions are above 100 TPY, hence these are the pollutants the facility will be required to keep track off.



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The Biomass Gasification Project is considered to be fuel conversion, as per discussion with the EPA in March 2005, and as per a written response letter from the EPA dated June 17, 2005. As such this project will fall into the less than 100 TPY category for PSD purposes (Fuel Conversion Plant).

As such the Biomass Gasification Project will be given the following Synthetic Minor Emission Limitations:

CP ID	Equipment ID	CP Issue Date	Pollutant	Emission Limitation (TPY)	BACT or Synthetic Minor (SM)
CH	Biomass gasification system	On public notice	SO <sub>2</sub> , NO <sub>x</sub> and CO	Less than 100 TPY each	SM

### SC Regulation 61-62.70 - TITLE V Operating Permit Program

Applicable This change will be a Minor Modification to the Title V permit.

### 40 CFR 60 - Standards of Performance for New Stationary Sources (NSPS)

Applicable The following emission sources at the facility are subject to the following NSPS Standards:

CP ID	Affected Source	Equipment ID	NSPS Standard	Limitations
CH	Biomass Gasification System (Boiler and Oxidizer only)	Biomass Gasification System (Boiler and Oxidizer only)	A – General Provisions and Dc - Standards Of Performance For Small Industrial-Commercial-Institutional Steam Generating Units	40 CFR §60.43c Standard For Particulate Matter, Part (b)

Not Applicable The Steam Turbine is not subject to Subpart GG - Standards of Performance for Stationary Gas Turbines, since the heat input at peak load is less than 10 million Btu per hour.

### 40 CFR 64 - Compliance Assurance Monitoring (CAM): (April 20, 1998)

Not Applicable This facility PTE exceeds Title V threshold limits (PTE >10/25 TPY HAP or >100 TPY criteria pollutants), but none of the equipment has control equipment associated with it.

### EMISSION LIMITATIONS

ID	Pollutant/Standard	Limit	Reference Method	Regulation	Periodic Monitoring
CH (Boiler and Oxidizer only are subject to NSPS, Subpart Dc)	Opacity	20%	9	40 CFR 60.43c and 40 CFR 60.47c(a)	Visual inspection annually
CH (Biomass Gasification System)	Opacity	20%	9	SC Regulation 61-62.5, Standard 1, Section I	PTE of PM for untreated wood waste does not exceed limit
CH (Biomass Gasification System)	PM	0.6 lb/million Btu heat input	5	SC Regulation 61-62.5, Standard 1, Section I	PTE of SO <sub>2</sub> for untreated wood waste does not exceed limit
CH (Biomass Gasification System)	SO <sub>2</sub>	3.5 lb/million Btu heat input	6	SC Regulation 61-62.5, Standard 1, Section I	PTE of PM for untreated wood waste does not exceed limit
CH (Biomass Gasification System)	PM	0.1 lb/million Btu heat input	5	40 CFR §60.43c(b)(1)	PTE of PM for untreated wood waste does not exceed limit
CH (Biomass Gasification System)	PM	0.2 lb/million Btu heat input	5	SC Regulation 61-62.5, Standard 5.2, Section III, Table 1 - NO <sub>x</sub> Control Standards	Recordkeeping
CH (Biomass Gasification System)	SO <sub>2</sub> , NO <sub>x</sub> and CO	Less than 100 TPY (each)	As Approved By BAQ	SC Regulation 61-62.1, Section II(H)	Recordkeeping



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### MONITORING AND REPORTING

ID	Pollutant/ Parameter	Limit	Required Monitoring	Monitoring Frequency	Reporting Frequency
CH	Fuel usage	N/A	Recordkeeping	Monthly	On site
CH	Opacity	20%	Continuously Opacity Monitoring System (COMS)	Continuously	On site
CH (Biomass Gasification System)	SO <sub>2</sub> , NO <sub>x</sub> and CO	Less than 100 TPY each	Recordkeeping	Monthly	Semi-annual

### SUMMARY AND CONCLUSIONS

It has been determined that this source, if operated in accordance with the submitted application, will meet all applicable requirements and emission standards.